

Sperm Competition in Marriage:

Semen Displacement, Male Rivals, and Spousal Discrepancy in Sexual Interest

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Highlights

- Semen-displacing copulatory behaviors are explored in married couples.
- The time wives spend with other men and husbands' sexual behavior are related.
- Men's sexual behaviors are related to differences in sexual interest between spouses.

Abstract

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2 Non-human males attend to the presence of potential sexual rivals in the local environment to assess sperm
3 competition risk, and adjust accordingly the deployment of sperm competition tactics (e.g., performing semen-
4 displacing copulatory behaviors). We extend this research to humans using data from 45 married couples who
5 completed questionnaires in a laboratory. We found that husbands whose wife spent more time with her male
6 coworkers and male friends (i.e., potential sexual rivals) performed more semen-displacing copulatory behaviors
7 at the couple's most recent copulation. We also found that performance of semen-displacing copulatory
8 behaviors correlated with a novel cue to sperm competition risk: the discrepancy between the husband's sexual
9 interest in his wife and her sexual interest in him. We also tested and refuted an alternative hypothesis that men
10 adjust their copulatory thrusting to facilitate their partner's orgasm. Discussion highlights the novel
11 contributions of the current research and notes limitations that can be addressed by future research.

12 *Keywords:* sperm competition, semen displacement, married couples, sexual rivals

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Sperm Competition in Marriage:**Semen Displacement, Male Rivals, and Spousal Discrepancy in Sexual Interest**

Sperm competition occurs when a female copulates with two or more males within a sufficiently brief time period, resulting in the sperm of the different males simultaneously occupying the female's reproductive tract and competing to fertilize ova (Parker, 1970). In humans, female infidelity is the primary context for sperm competition (Baker and Bellis, 1993a; Shackelford, Goetz, McKibbin, and Starratt, 2007; Shackelford et al., 2002; Smith, 1984). Men whose regular partner engages in extra-pair copulation are at risk of cuckoldry—the unwitting investment of resources into genetically unrelated offspring. The reproductive costs of cuckoldry may have caused the evolution of male sperm competition tactics—adaptations that increase sperm competition success (Shackelford and Goetz, 2007).

Semen-displacing copulatory behaviors (e.g., deeper, more vigorous copulatory thrusts) may function as sperm competition tactics in humans (Gallup et al., 2003; Pham et al., 2013). Using artificial genitals, Gallup et al. (2003) found that the morphology of the human penis appears to be capable of displacing rival semen from the female reproductive tract. Additionally, the post-ejaculatory refractory period may function to prevent displacement of own recently-ejaculated semen (Gallup and Burch, 2004; Gallup, Burch, and Mitchell, 2006). Men perform more semen-displacing copulatory behaviors when they are at greater sperm competition risk, such as when they are partnered to a more attractive woman (Goetz et al., 2005), accuse their partner of sexual infidelity (Gallup et al., 2003), and have spent more time apart from their partner since the couple's last copulation (Gallup et al., 2003). Semen-displacing copulatory behaviors also co-occur with the performance of other anti-cuckoldry tactics (e.g., non-sexual mate guarding behaviors; Goetz et al., 2005).

Another cue to sperm competition risk that may correlate with semen-displacing copulatory behavior is the presence of rival males. Research on non-humans documents that the presence of rival males causes the deployment of sperm competition tactics (Candolin & Reynolds, 2002; Gage & Barnard, 1996; Pizzari, Cornwallis, Lovlie, Jakobsson, & Birkhead, 2003; Møller, 1985). Two studies have investigated the presence of rival males as a cue to sperm competition risk in humans. Pham and Shackelford (2013) found that men who spent more time apart from their partner since the couple's last copulation also report greater interest in copulating with her and greater distress if she refused a request for copulation, but *only* if she recently spent

41 more (versus less) time with male friends. Pham et al. (2014) found that men whose partner has more male
42 coworkers and male friends (i.e., potential sexual rivals) also copulate more frequently with her. Frequent
43 copulation may facilitate more semen-displacing copulatory behaviors, but also may serve other functions (e.g.,
44 sexually satisfying a partner). Following previous research (Pham & Shackelford, 2013; Pham et al., 2013), we
45 hypothesize that men whose partner spends more time with male coworkers (Hypothesis 1) and male friends
46 (Hypothesis 2) will perform more semen-displacing copulatory behaviors (e.g., deeper thrusting of penis into
47 vagina) at the couple's most recent copulation.

48 We also investigated in the current research a novel measure of sperm competition risk: the discrepancy
49 in sexual interest between romantic partners. Men at greater risk of sperm competition report greater interest in
50 copulating with their partner (Pham & Shackelford, 2013; Shackelford et al., 2002, 2007), and women who
51 recently engaged in extra-pair copulation (i.e., presenting greater sperm competition risk) report attempting to
52 delay copulation with their in-pair partner (Gallup et al., 2006). We therefore hypothesize that men who report
53 greater interest in copulating with their partner—compared to their partner's interest in copulating with them—
54 will perform more semen-displacing copulatory behaviors (Hypothesis 3).

55 An alternative (but not mutually exclusive) hypothesis is that men perform deeper copulatory thrusts to
56 facilitate their partner's orgasm. Men may facilitate their partner's orgasm to increase her sexual satisfaction
57 and, consequently, reduce her extra-pair copulatory desire (i.e., sperm competition risk). Additionally, Baker
58 and Bellis (1993b) provided evidence that women who experience orgasm near the time of their partner's
59 ejaculation retain more of his sperm in their reproductive tract, potentially increasing his chances of success in
60 sperm competition. To test this alternative hypothesis, we secured wives' reports of their enjoyment of sex with
61 their partner, in general, and their occurrence of orgasm, in particular.

62 Previous research on human sperm competition has secured data from university students (Shackelford
63 et al., 2002, 2007), community members (Pham & Shackelford, 2013), and prisoners (Camilleri & Quinsey,
64 2009), demonstrating that putative adaptations to sperm competition are expressed in demographically diverse
65 samples. We extend this line of research by securing data from legally married couples. Marriage is a
66 universally-practiced, public declaration of commitment to a long-term romantic relationship (Nock, 1995).
67 Because female extramarital infidelity is the primary context for human sperm competition (Smith, 1984), and

68 because marriage is ubiquitous across cultures (Betzig, 1989), it is important to investigate whether the putative
69 adaptations to sperm competition manifest differently in marriages than in relationships for which the
70 commitment is lower or has not been publically declared and recognized.

71 **Method**

72 **Participants and Procedure**

73 Forty-five heterosexual married couples ($n = 90$) arrived together to a university laboratory in the
74 Southeastern region of the United States. This sample size was based on available funds. The average
75 relationship length was 9.4 years ($SD = 12.5$). The average age was 36.3 years ($SD = 12.5$) for husbands and
76 34.5 years ($SD = 12.5$) for wives. Eligible participants reported being legally married. Participants were
77 presented with a written consent form. Those who provided consent were provided with a survey, which each
78 completed privately in a room separate from their spouse. Those who did not provide consent, or who reported
79 that they were not legally married, were excluded from the study. Each participant was compensated US\$50 for
80 participation.

81 **Materials**

82 Participants reported their age and current relationship length. Following Pham et al. (2014), husbands
83 reported on several behaviors during the most recent copulation with their wife on 10-point scale, with reference
84 to what is typical for them: number of copulatory thrusts (0 = *fewer*, 9 = *more*), depth of the deepest copulatory
85 thrust (0 = *less deep*, 9 = *more deep*), and depth of the average copulatory thrust (0 = *less deep*, 9 = *more deep*).
86 Husbands reported the amount of time their wife currently spends with her male co-workers and male friends on
87 a 10-point scale (0 = *no time spent*, 9 = *very much time spent*). Husbands and wives self-reported their current
88 sexual interest in their spouse, compared to what is typical for them (0 = *much less interested*, 9 = *much more*
89 *interested*). Husbands reported whether their wife achieved orgasm during the couple's last copulation (1 = *yes*,
90 2 = *no*, 3 = *not sure*). Wives reported whether they achieved orgasm during the couple's last copulation (1 = *yes*,
91 2 = *no*). Wives also reported their level of sexual excitement during the couple's last copulation (0 = *much less*
92 *sexually excited than is typical*, 9 = *much more sexually excited*), how good it felt during their last copulation (0
93 = *much worse than usual*, 9 = *much better*), and how much relief they felt after intercourse (0 = *much less than*
94 *usual*, 9 = *much more*).

Results

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96 The Table presents zero-order correlations among the target variables. Following Pham et al. (2014), we
97 computed a composite *semen-displacing copulatory behavior* variable ($\alpha = .72$) as the mean of the husband's
98 reports of his number of copulatory thrusts, and the depth of the deepest copulatory thrust and average
99 copulatory thrust. To test Hypotheses 1 and 2, we correlated semen-displacing copulatory behavior with
100 husband's reports of the amount of time his wife recently spent with her male co-workers (Hypothesis 1) and her
101 male friends (Hypothesis 2). Consistent with Hypotheses 1 and 2, men married to women who recently spent
102 more time with male coworkers and male friends performed more semen-displacing copulatory behavior at the
103 couple's most recent copulation: $r(40) = .36, p < .05$ (male co-workers), $r(40) = .38, p < .05$ (male friends).

104 To test Hypothesis 3, we calculated the spousal discrepancy in current sexual interest by subtracting the
105 wife's interest in copulating with her husband from the husband's interest in copulating with his wife. We then
106 correlated scores on this variable with semen-displacing copulatory behavior. Consistent with Hypothesis 3,
107 husbands who reported greater relative interest in copulating with their wife also reported performing more
108 semen-displacing copulatory behavior at the couple's most recent copulation: $r(40) = .50, p < .01$.

109 To test an alternative hypothesis that men adjust their copulatory thrusting to increase their partner's
110 sexual satisfaction and to facilitate their partner's orgasm, we conducted a logistic regression to predict the
111 occurrence of the wife's orgasm (using husband's reports) from the husband's semen-displacing copulatory
112 behavior. We excluded from analyses data from eight husbands because they reported uncertainty about whether
113 their wife achieved orgasm. Inconsistent with the alternative hypothesis, husbands' semen-displacing copulatory
114 behavior did *not* predict their wife's orgasm: $n = 36, \chi^2(1) = .94, p = .33$. Because women sometimes pretend
115 orgasm (Kaighobadi, Shackelford, & Weekes-Shackelford, 2012), we conducted the same logistic regression,
116 this time using wife's reports of the occurrence of their orgasm. The alternative hypothesis remained
117 unsupported: $n = 44, \chi^2(1) = .93, p = .33$. Additionally, because some women experience greater difficulty
118 achieving orgasm (Dunn, Cherkas, & Spector, 2005), we conducted zero-order correlations to investigate
119 whether husbands' semen-displacing copulatory behaviors correlated with wives' enjoyment of sex as measured
120 by feelings of excitement during intercourse, physical sensations of pleasure throughout the copulatory episode
121 (and not just associated with orgasm), and feelings of relief experienced after the copulatory episode. The

122 correlations between these variables and semen displacing behavior were not significant: $r(40) = -.20, p = .39$;
 123 $r(40) = -.16, p = .47$; $r(40) = -.13, p = .55$, respectively. Therefore, the alternative hypothesis remained
 124 unsupported.

125 Table. Zero-order correlations among target variables.

126 Note: $n = 42$. * $p < .05$, ** $p < .01$.

	1.	2.	3.	4.	5.	6.
1. Number of thrust	X					
2. Deepest Thrust	.21	X				
3. Average Thrust	.21	.86**	X			
4. Husband's sexual interest	.18	.27	.26	X		
5. Wife's sexual interest	-.35*	-.33*	-.34*	-.02	X	
6. Time with male friends	.23	.39*	.28	.06	-.19	X
7. Time with male co-workers	.31*	.26	.28	-.07	-.22	.65**

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Discussion

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The results of the current research support the hypotheses that men married to women who spend more time with male coworkers (Hypothesis 1) and male friends (Hypothesis 2) report performing more semen-displacing copulatory behavior at the couple's most recent copulation. In addition, the results support the hypothesis (Hypothesis 3) that men who report greater interest in sex with their wife than their wife reports in them perform more semen-displacing copulatory behavior during the couple's most recent copulation. We did not find support for an alternative hypothesis that husbands adjust their copulatory thrusting to increase their wife's sexual enjoyment or to facilitate her orgasm. Taken together, these results are consistent with the broader hypothesis that men attend to partner infidelity cues and adjust accordingly their deployment of sperm competition tactics.

138 The current research is the first to secure data from married couples to investigate hypothesized
139 adaptations to human sperm competition. The results of this research replicate several findings identified in
140 previous research with different samples, showcasing the robustness of the putative anti-cuckoldry adaptations
141 in human male psychology. Despite the significant gesture of commitment marked by formal marriage, men
142 continue to deploy sperm competition tactics because the reproductive costs of cuckoldry are severe. Indeed,
143 Buss and Shackelford (1997) found that men commonly and often frequently perform multifarious behaviors to
144 reduce the risk of their wife's infidelity.

145 The current research is also the first to integrate two concepts related to sperm competition risk: men's
146 sexual interest in their partner in response to sperm competition risk (Shackelford, et al., 2002) and women's
147 sexual disinterest in their partner following an extra-pair copulation (Gallup et al., 2006). Previous research on
148 human sperm competition has relied on men's self-reports of copulatory behaviors (e.g., Shackelford et al.,
149 2002, 2007; Pham et al., 2013, 2014). Although men's self-reports are appropriate and defensible when
150 investigating the functioning of male psychological mechanisms (i.e., men's self-reported perceptions are
151 relevant inputs into these mechanisms), the current research highlights the importance of female psychology and
152 the active role that women play in human sperm competition—phenomena that have received less attention in
153 the literature (but see Baker & Bellis, 1993b; Gallup et al., 2006; Kaighobadi et al., 2012). In fact, in research on
154 non-human sperm competition, there also is a much richer and more extensive literature addressing male
155 adaptations than female adaptations—due, in part, to the greater methodological difficulty of investigating
156 female adaptations, many of which are internal to females (e.g., females biasing the outcome of sperm
157 competition in their reproductive tract: Birkhead, 1998).

158 Displacement of rival male semen from a partner's reproductive tract is a possible explanation for why
159 men adjust their copulatory thrusting, and the results of the current research corroborate this hypothesis.
160 However, men also may perform deeper copulatory thrusts to increase their own sexual arousal and consequent
161 ejaculate quality. This could be related to individual difference factors such as whether a man's penis is intact or
162 circumcised, as circumcised men tend to report deeper and more vigorous thrusting, possibly due to the loss of
163 sensitivity associated with circumcision (O'Hara & O'Hara, 1999). However, another consequence of
164 circumcision is enhanced semen-displacing properties of the penis compared to penises that are intact (Gallup &

165 Burch, 2004). Future research might investigate such differences. Ejaculate adjustment is a widely-documented
166 sperm competition tactic across taxa (see Simmons & Fitzpatrick, 2012). Future research might also secure
167 copulatory ejaculates to investigate whether self-reported semen-displacing copulatory behavior correlates with
168 consequent ejaculate quality. A further limitation of the current research is the small sample due to the labor-
169 intensive nature of the study and funds available for participant remuneration. Therefore, future research should
170 replicate this study using larger sample size.

171 The current research adds to the growing empirical literature on human sperm competition, in general,
172 and the ways in which men assess and respond to sperm competition risk, in particular. Men are at greater sperm
173 competition risk when they spend more time apart from their partner since the couple's last copulation, when
174 they are mated to more attractive women, and when they are mated to women with personality traits associated
175 with female infidelity (see Pham & Shackelford, 2014). The current research documents that men attend to the
176 presence of rival males in the local environment as a cue to sperm competition risk—a finding that has been
177 previously documented (e.g., Pham & Shackelford, 2013; Pham et al., 2013). We also include a variable only
178 recently identified as a cue to sperm competition risk: spousal discrepancy in sexual interest (Gallup, et al.,
179 2006), as measured in a novel way by subtracting the wife's interest in copulating with her husband from her
180 husband's interest in copulating with her. Finally, despite the ubiquity of marriage across cultures, married
181 couples have received no attention from research on human sperm competition. The current study is the first to
182 extend previous research to a sample of legally married couples.

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